Incorporating "The Illuminating Engineer."

Light and Lighting

Official Journal of the Illuminating Engineering Society.

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Principal Contents:

The Lamps are Going Out . . . .

"THE Lamps are Going Out, One by One, all Over Europe . . . ."—a famous phrase spoken by Earl Grey at the commencement of the last great war.

Now, only 25 years afterwards, the incredible has again happened. Another world conflict has begun and the lamps are going out once more.

All that remains is for each one of us to keep the torch of the spirit kindled and to remain steadfast during the coming dark period, knowing full well that there will come a time when the lights shine out again.

Meantime let it not be assumed that, because our sources of light and equipment must henceforth be hidden, there is no longer need for the services of the illuminating engineer.

The greater part of the services rendered by artificial light, in the home, shop, and factory, must still be given, even though their results are concealed from view.

Moreover, as the record of the work of the various I.E.S. "A.R.P. Lighting" Committees shows (see page 185), the skill of the lighting expert remains in demand, even when darkening rather than illuminating is the process involved.

The Great Black-Out

The outbreak of hostilities has been followed, as anticipated, by a general "black-out." The singular conditions that prevail after sunset have been patiently and cheerfully accepted by all. We shall, no doubt, learn from these experiences. It is even possible that these experiences may ultimately lead to some modification of the general gloom. In the meantime, let it not be assumed too hastily that there must also be a "black-out" of all efforts to carry on business and acquire knowledge. There remains plenty of scope for the efforts of lighting experts, even if their achievements must be hidden from hostile view. The Illuminating Engineering Society is already proving its worth, but its potential value to the nation is probably far greater than is yet appreciated. There is every reason why those who are free to do so should tenaciously pursue its objects and determine that its unique spirit of fellowship shall be preserved. It is unfortunate that direct contact between the members of scientific and technical bodies should be so hampered at the present time. It was, of course, quite inevitable that the Conference of the Association of Public Lighting Engineers in Glasgow should be postponed—a great disappointment. Organised general meetings of the Illuminating Engineering Society must likewise be held over for the moment. But less formal, smaller gatherings of committees, etc., are still possible—they have been proceeding almost without intercession during recent weeks in connection with researches on A.R.P. lighting. Furthermore, where the spoken word is interrupted let the written word prevail. Let those charged with the duty of preparing papers devote part of the dark evenings to getting them into graphic shape. Under the best conditions they will be ready for presentation at meetings when happier times arrive—at the worst they will be available for publication.

We shall continue the publication of *Light and Lighting* so long as it is humanly possible to do so. *We ask all readers and all members of the Society, whatever their duties and wherever they may be, to keep us informed of their addresses and to send us notes from time to time of their activities.* Such notes will be read with zest by others all over the world and will help to preserve contacts which we believe will prove of great value during the dark time before us.

Sodium Street Lighting at Salisbury

Inaugurated on August 25

Castle Road, Salisbury, as it appeared at the inauguration on August 25.

It was unfortunate that the inauguration of this installation, on August 25, was followed almost immediately by the outbreak of war. The system utilises 140 w. sodium lamps, with an initial luminous efficiency of 71.5 lumens per watt, mounted in lanterns incorporating the latest design of holophane dual prismatic panels. Lamps are mounted 25 ft. high with an average spacing on main routes of 120 ft. and an output of 5,000 lumens per 100 linear ft. of roadway. The sodium lamps with their associated electrical gear were supplied by Messrs. Philips Lamps, Ltd., and the Edison Swan Electric Company, Ltd. For the control of the system the D.C. bias system developed by Standard Telephones and Cables, Ltd., is employed. Let us hope that it may not be so very long before conditions are such as to enable this new lighting to play its normal part in illuminating the King's Highway.

The I.E.S. Will Carry On

The Illuminating Engineering Society is prepared to carry on from its present address in Victoria-street, London.

For the moment it is unavoidable that meetings arranged for the immediate future should be postponed, but the situation will be reviewed after a couple of months, when the position may be more favourable.

Meantime the I.E.S. is not inactive. Through the agency of a series of sub-committees a variety of problems is being explored. Some are mentioned on pp. 185-190. There will doubtless be an increased demand for the services of members on sub-committees handling these and further problems.

It is hoped to continue the regular publication both of the "Transactions" and "Light and Lighting," for which no lack of interesting matter is anticipated.

Some Notes on A.R.P. Lighting

The Complete Black Out—Seeing in the Dark—Special External Lighting—Fittings to Give Uniform Illumination of Low Intensity—Specifications for 0.002, 0.02 and 0.2 ft.c.—Interior Screening of Lighted Interiors—Complementary Lighting—Light-Locks for Shops, etc. — Other Problems.

The problem of " A.R.P. Lighting," as it has come to be termed, is a most difficult one for the illuminating engineer in that the conditions imposed by the emergency often run directly counter to his normal actions and aspirations. To take only a single instance, it is obvious that if the threat of hostile action from the air is to be regarded as permanent windows for the admission of daylight become an embarrassment. In the case of existing buildings, where very large glass areas exist, complete screening becomes so difficult and costly as to be almost prohibitive, and it might well be urged that in the case of new buildings the simplest plan would be to make no provision for window-space, relying entirely on artificial lighting and air-conditioning within the shell of the building. This, of course, runs counter to the accepted idea that " where the sun does not enter the doctor comes " and is opposed to the marked tendency to make more and more use of glass in the structure of buildings—as exemplified in the natural development of architectural design during recent years. The adoption of a minimum " daylight factor " in schools and factories has long been a common aim of lighting experts and hygienists.

It is, of course, the fervent hope of all of us that this nightmare will be removed, but the time is not yet. Experience and investigation carried out on scientific lines may bring relief, but at present it must be admitted that no other course could be insisted upon than complete extinction.

In the emergency in which we now find ourselves we must bear in mind that the decision of the authorities cannot be based merely on technical detail, and is influenced by many considerations quite removed from illuminating engineering.

For the present, therefore, we have to accept the condition of all outdoor lamps being extinguished. It is remarkable in such circumstances how valuable the markings of white paint become, and how useful, when one's eyes have become adapted, the light from the stars and even the night sky proves to be. The utility of such devices as the adoption of white armlets for pedestrians and white markings for motor-cars in the present circumstances may possibly influence future action—even in normal circumstances. It will be instructive, in time to come, to study records of street accidents under such singular conditions. One evident danger—illustrated by the article by Luckiesh and Moss in our last issue*—is the fact that a certain proportion of people are " night-blind," whilst the faculty of " seeing in the dark " varies to a remarkable extent even amongst normal people. Of special importance in this connection is the effect of adaptation of the eyes to night conditions, which may take a considerable time. In any measures that can be taken to alleviate the present conditions one has to consider not only the case of persons who have been in the dark streets for some little time, but also the condition of those who have only just emerged from brightly lighted interiors, and who are not yet in a state to perceive objects of very feeble brightness.

* Light and Lighting, Aug. 1939, p. 165.

Special External Lighting.

Whilst the statement that no external lighting can be allowed is almost universally true, it is recognised that there may be certain areas where it is of vital importance that persons should at least have enough light to see their way about and to conduct very simple operations.

This question is one of a number that has been the subject of study for some time by a special Committee on which the Illuminating Engineering Society is represented, and which is being aided by numerous sub-committees on which other members of the Society are serving.

To meet the requirements of such special cases it has been decided that an illumination not exceeding 0.002 ft.c. might sometimes be permitted by the Authorities concerned. A British standard specification (BS/ARP/16), issued under the aegis of the above Committee, defines the conditions to be met by fittings for such installations as follows:—

(a) The fittings shall not emit any measurable light above 5 per cent. below the horizontal.

(b) The light output shall be such that, when installed as specified below, the fittings shall produce and maintain a horizontal illumination of approximately 0.002 ft.c. at ground level.

(c) When the fittings are installed as recommended, the illumination on a horizontal surface shall be reasonably uniform.

(d) For conversion purposes each fitting as a whole shall be capable of insertion in or attachment to the existing electric holder or gas fitting which is to be converted.

It is obvious that these conditions can be met in a great variety of ways. In the case of an alternating current installation it would often be advantageous to reduce the voltage by means of a local transformer and to substitute low-voltage low c.p. lamps. Alternatively chokers or condensers may be inserted in the main circuit to diminish the light or—a favourite device—lamps of lower c.p. coated with blue obscuring material may be inserted in existing holders. Gas lighting installations may be similarly dealt with by reduction of pressure, the use of special mantles, etc. A difficulty about many such devices, however, is that the resultant illumination may be far from uniform, and such variations are of more practical importance at such very low illuminations than when the illumination is relatively high.

Electric and Gas Units.

In order to illustrate how the problem can be tackled the specification illustrates forms of electric and gas units which, at heights of 10, 15, and 20 ft., will give a reasonably uniform illumination of 0.002 ft.c. The electric fitting uses a 15-watt filament pearl lamp mounted in an iron or aluminium shade with a cup of the same material, as illustrated in Fig. 1. The adjustment necessary to enable the arrangement to answer at different heights is effected by altering the internal coating of the shade which, with 10-ft. mounting height, is dead black (reflecting not more than 5 per cent.), and at 15 and 20 ft. is a tint of " battleship grey " (reflecting respectively 10-15 per cent. and 20-30 per cent. of light). The specification carries, as an appendix, actual specimens of these three tints from which Fig. 3 is here reproduced. The reproductions here (see Fig. 3) are naturally not exact, but give an idea of the relative depth of the three tints. It is directed that the spacing shall not be less than four times the

mounting height above the ground level, and that the fitting shall be maintained in a vertical position.

The corresponding gas unit utilises a mantle surrounded by a cylindrical silica ("Vitreosil") globe, with a shade cup and shield (painted internally dead black), details of which are shown in Fig. 2. The same fitting is used at the three heights except that an upper reducing shield is used at 15 ft. only. At 10 ft. one "limina" mantle (500 B.Th.U./Hr.) is used and at 15 ft. and 20 ft. one B.S. ("Bijou") mantle (875 B.Th.U./Hr.) is adopted. The spacing in this case is given as not less than five times the mounting height above ground level.

Specifications for 0.002, 0.02, and 0.2 ft.c

The fittings referred to above will serve to give moderately even illumination of the very weak value of 0.002 ft.c. Observations seem to confirm the belief that a horizontal area so illuminated would be very inconspicuous from above, at least at the heights likely to be possible for hostile aircraft over a city. Nevertheless, users should bear in mind that the vertical illumination on, say, a wall near to one of the lighting units might reach a very much higher figure. It is expedient, therefore, to make sure that no lighting units are mounted near to extensive vertical surfaces, especially those of a light colour, such as concrete walls, etc.—nor in positions where direct reflections from water, visible from above, are apt to occur.

In response to a further demand by the authorities, further specifications designed to afford a somewhat higher illumination, 0.02 and 0.2 foot-candles, are being prepared. A specification (BS/ARP/20) for 0.02 foot-candles (which is of the same order as bright moonlight) has already been issued. The requirements are in form generally similar to those in BS/ARP/16 except that the illumination is ten times as high. The electric unit in this case uses a 100 watt lamp throughout, and the shade and cup are similar, though the dimensions (see Fig. 4) have been slightly modified. At 10 ft. the internal coating is again dead black (reflecting power not above 5 per cent.), but at

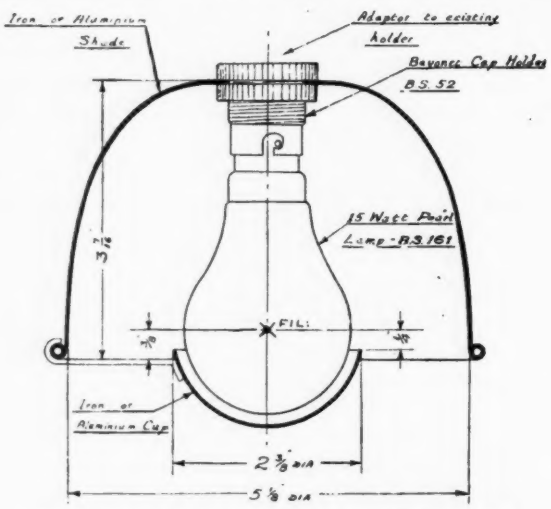


Fig. 1. Electric fitting to furnish an even illumination of 0.002 ft.c.

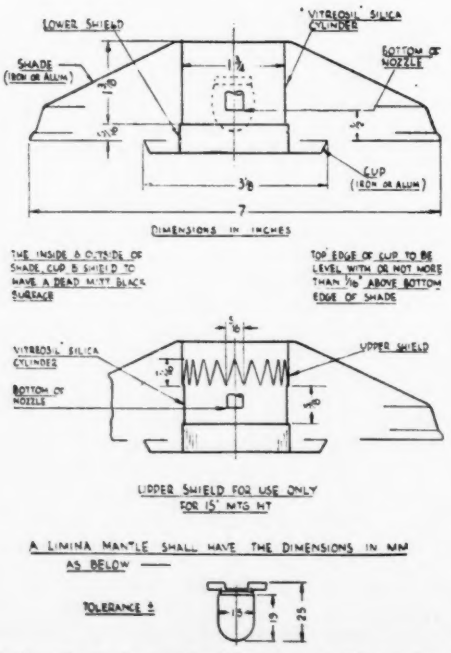


Fig. 2. Gas fitting to furnish an even illumination of 0.002 ft.c.

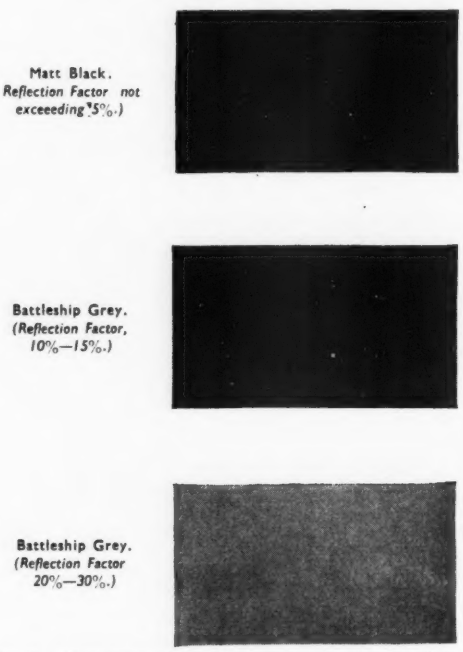


Fig. 3. Specimens of interior coatings for electric fittings, to furnish 0.002 ft.c.

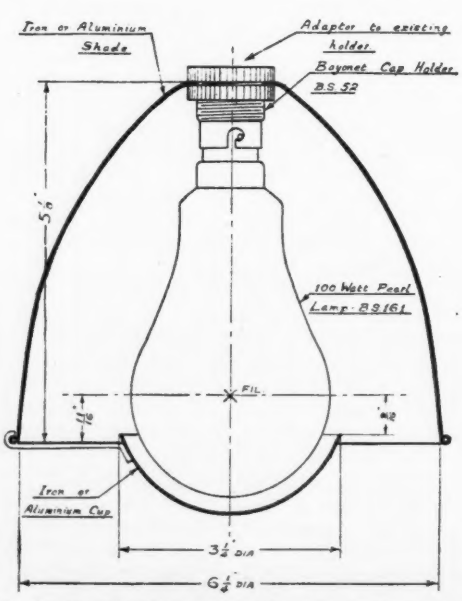
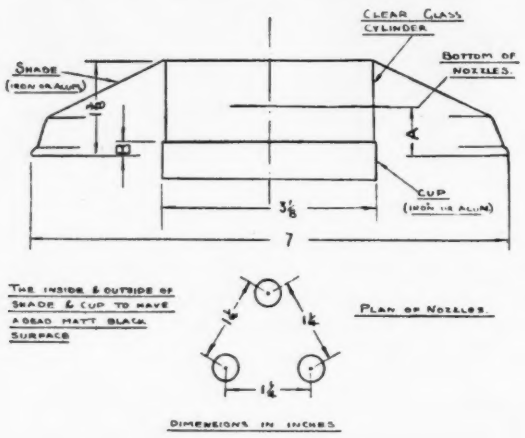


Fig. 4. Electric fitting to furnish even illumination of 0.02 ft.c.

15 and 20 ft. the battleship grey tint should give a reflection 5-10 per cent. and 10-15 per cent. respectively.

In the case of the gas unit, the special shield is dispensed with. Three B.S. ("Bijou") mantles are used at all heights, but the critical dimensions affecting the positions of the mantles within the fitting are varied according to the height, as shown in Fig. 5.

For both gas and electric units the same limiting



Mounting Height	10 ft.	15 ft.	20 ft.
Dimension A, inch	1 1/16	1 1/16	1
Dimension B, inch	3/16	0—1/16	0—1/16

Fig. 5. Gas fitting to furnish even illumination of 0.02 ft.c.

values for spacing as specified in BS/ARP/L16 are prescribed.

A specification for 0.2 foot-candles is still in course of preparation.

It is intended to designate fittings corresponding to the three grades of illumination by the descriptions IES/ARP/.002, IES/ARP/.02, and IES/ARP/.2 respectively.

Interior Lighting.

Whilst these three ranges of illumination are being kept in view for outside use in cases where essential operations are being carried on, it should be understood that they will only be permitted in special circumstances, and, even so, the higher grades will certainly have to be extinguished whenever an air raid warning is received.

On this understanding they may likewise be used in yards, corridors, etc., attached to factories engaged on important operations, when a permit is obtained. But, generally speaking, the only safe rule to be followed in regard to interior lighting is to ensure that *all* exposure of light is eliminated. A resolution approved by the Illuminating Engineering Society states that: *Effective and adequate illumination for the carrying on of work in factories is only practicable on the assumption that means are provided to screen completely, by opaque materials, any upward and outward emission of light through the windows of the buildings.**

This deliberate decision is of interest in view of the numerous lighting devices still being recommended as rendering screening unnecessary. Many of these will not bear investigation in view of the stringent view taken in regard to complete blacking out; it is not perhaps sufficiently appreciated that a white object receiving even very weak illumination may be seen miles away on a dark night.

Light-Locks.

Another problem, likely to be met in the case of many types of lighting installations, but more particularly in the case of shops and stores, is the provision of "light-locks" such as will enable people to enter and leave premises at night, when all outdoor lighting is reduced to a minimum, without any visible light emerging from the interior of the shop.

This problem is dealt with in another B.S.I. specification (BS/ARP/15) prepared by an I.E.S. Committee. The essential features of the light-lock are shown in Fig. 6. It consists essentially in a passage having dark walls and ceiling and with two right-angle turns, one of which opens into the street and the other on to the interior of the shop.

If "a" denotes the width of the passage, then the length of the complete outer wall shall not be less than $3a$, and the length of the other walls not less than $2a$, thus giving a central overlap equal to a, which will ensure that no direct ray of light from the interior of the shop can penetrate further than the end of the passage entered from the street. The width of the passage will naturally depend on the purpose

* An exception to this ruling is furnished by those premises in which the needs of visibility can be met by coating control apparatus, switches, dials of instruments, etc., with fluorescent material, which is illuminate irradiated by ultra violet radiation from mercury lamps with "black" bulbs. In such special cases, in which weak light serves for purposes of indication and not to illuminate processes, complete screening of windows may not be obligatory.

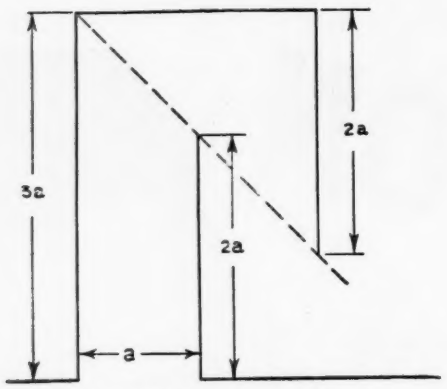


Fig. 6. Essential dimensions of light lock.

served and the space available, but it should in no circumstances be less than 2 ft. 3 in.

Directions in the specification govern the treatment of the interior of the lock and the provision of artificial light therein, materials for partitions, folding doors and exits, gradation of light in the vicinity of light-locks, etc. The walls and ceiling of the lock should be painted dead black, but white horizontal guide lines 2 in. wide should be drawn 3 ft. 6 in. above floor level for adults and 2 ft. 6 in. for children. The floor may be of any dark material which does not take a polish. Where a step down occurs at the entrance to a shop it should be painted dead white. In the interests of safety subdued light, provided either by an aperture, covered by translucent material, in the wall or by the provision of a unit of the type recommended in BS/ARP/20 mounted on the ceiling Partitions may be made of plywood or fibrewood, which may be subjected to fireproofing with advantage (in which case the dead-black coating should be applied after the fireproofing), and may be prepared in hinged sections, quickly erected in an emergency. Emergency exists, providing free exit in case of panic should be provided. With a view to lessening the contrast between the bright interior lighting and the very subdued brightness within the lock and aiding the adaptation of the eyes, lights in the vicinity of entrances to the interior of the shop should be shielded. Some diminution in the intensity of the light in this vicinity is also advantageous.

Some examples of the application of this idea are seen in Figs. 7 and 8. In the case of large shops and stores the arrangement of light-lock presents no

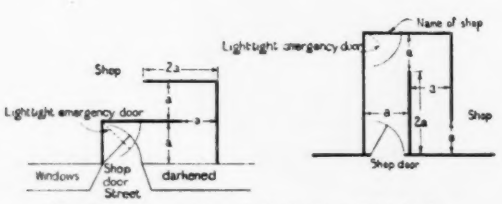


Fig. 7(a). Examples of single-type light locks.

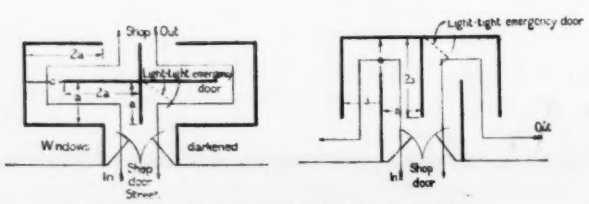


Fig. 7(b). Examples of double-type light locks.

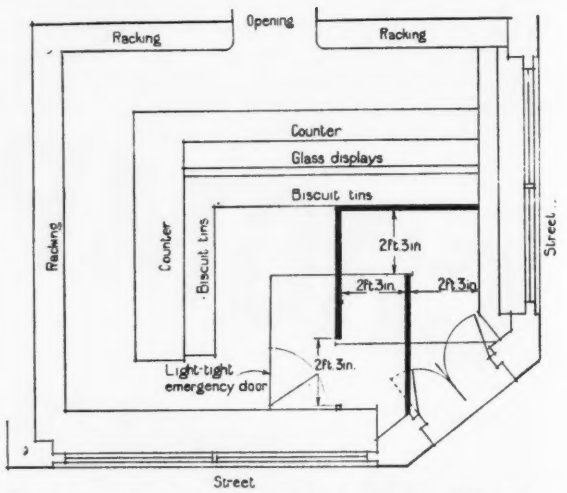


Fig. 8. Example of a shop on a corner site fitted with light lock.

great difficulty, and a number of good examples are already to be seen in London. In small shops, where the space available is so much less, the arrangement is less easy, though experiments have shown that with a little ingenuity quite effective light-traps can be contrived. At present, however, it seems as though the majority of shops, in view of the dark condition of the streets, difficult alike for staff and shoppers, will make a practice of closing before dusk.

Other Problems.

In forthcoming issues we shall deal with other problems.

Amongst these is the question of the advantages or drawbacks of coloured light. There is a general disposition to make use of blue-tinted lamps, mainly, no doubt, because this is one of the readiest ways of dimming the light. It is, however, an uneconomic process and in general it seems better to adopt, so far as possible, methods involving a reduction in the consumption of energy as well as diminution in light.

There is also an impression that for a given intensity blue light is less visible than white from a distance. The problem is a complicated one. It is a familiar fact that faint light from the blue end of the spectrum disappears when viewed from a distance by direct vision—owing to insensitiveness of the fovea of the dark adapted eye. Unfortunately this apparent advantage is counteracted by the fact that the peripheral region of the retina is highly sensitive, so that such lights "blaze up" when seen by oblique vision ("out of the tail of the eye"). It has also been urged that blue light is readily absorbed by the atmosphere and that this tends to reduce its visibility at a distance; on the other hand its tendency to form a species of luminous veil or halo is apt to prove a drawback. On the whole, therefore, there seems reason to endorse the view expressed abroad that there is no inherent advantage in using blue light, and that in general it is better to avoid the use of any form of coloured light, which is liable to attract attention.

Finally, there is the important question of the properties of fluorescent and phosphorescent materials and the various special applications in darkened places. On this and other outstanding problems in some of which the Illuminating Engineering Society and the British Standards Institution are jointly interested, it is hoped to say something further in our next issue.

Recommended Practice of Industrial Lighting

Notes on Recommendations appearing in the Transactions of the Illuminating Engineering Society (U.S.A.): Vol. XXXIV, No. 4, April, 1939, pp. 369-408.

The Committee for Industrial and Factory Lighting of the Illuminating Engineering Society (U.S.A.) last April submitted a Code for Factory Lighting and invited criticism and suggestions for its improvement.

The Code is a result of research in various lines of engineering production. It explores all possible avenues to improve lighting and the effect of such improvements on actual production. At the outset eight points in favour of improvement are mentioned, among which are better utilisation of floor space, increased production and decreased costs, and fewer accidents.

The conclusion is reached that for general illumination it is desirable to provide a value round about 20 ft.c. as the minimum to ensure ease in seeing. In connection with the better utilisation of floor space attention is drawn to the habit of placing difficult seeing tasks close to a window, which has hitherto been responsible for much waste in crowded workrooms and inefficient lay-out of plant. General illumination should be at a level sufficient to meet the more severe demands of the weaker eyes of older employees. It is recommended that at least one member of the electrical engineering staff at each factory should be appointed to take definite charge of lighting arrangements.

The chief factors which constitute good lighting include avoidance of glare, good diffusion of light, and correct distribution. Two familiar forms of glare—direct and reflected—are discussed. The display of bright light sources against the low brightness levels of dark ceilings should be avoided and, similarly, bright windows with a surround of darker walls.

Recommended Values.

Recommendations are tabulated for requisite values of illumination, figures being given for about fifty different industries, some of which are reproduced in Table I.

TABLE I.

*Recommended Minimum Standards of Illumination for Industrial Interiors.**

	foot-candles
Bookbinding	
Folding, Assembling, Pasting, etc.	10
Cutting, Punching, and Stitching	20
Embossing	20
Breweries	
Brew House	5
Boiling, Keg washing, and Filling	10
Bottling	15
Cloth Products	
Cutting, Inspecting, Sewing	
Light Goods	20
Dark Goods	A
Pressing, Cloth Treating (Oil Cloth, etc.)	
Light Goods	10
Dark Goods	20
Automobile Garages	
Storage—Live	10
Storage—Dead	2
Repair Department and Washing	C
Machine Shops	
Rough Bench and Machine Work	10
Medium Bench and Machine Work, Ordinary Automatic Machines, Rough Grinding, Medium Buffing and Polishing	20
Fine Bench and Machine Work, Fine Automatic Machines, Medium Grinding, Fine Buffing and Polishing	B
Extra Fine Bench and Machine Work, Grinding	A
Offices	
Book-keeping, Typing, and Accounting	30
Calculators, Key Punch, Book-keeping	B
Conference Room	
General Meetings	10
Desk Work	
Intermittent Reading and Writing	20
Prolonged Close Work, Computing, Studying, Designing, etc.	C
Reading Blueprints and Plans	30
Drafting	
Art Drafting and Designing in Detail	C
Rough Drawing and Sketching	30
Filing and Index References	20
Lobby	10
Mail Sorting	20
Reception Rooms	10
Prolonged Reading Shorthand Notes	C
Vault	10

* Selected from the complete list.

It is interesting to observe a departure from the usual procedure in tabulating foot-candles for specific occupations. In some instances definite numerical values are not quoted; instead letters ("A" to "D"), which correspond with special recommendations set out at the end of the schedule.

Group "A" operations are those such that the seeing task involves the discrimination of very fine detail under conditions of poor contrast for a long period. For such operations a local illumination of the order of 100 ft.c. is recommended in addition to a general illumination of 20 ft.c. The construction and design of fittings securing these conditions are described in detail. Group "B" operations relate to visual tasks involving the discrimination of fine detail under less severe conditions. The illumination recommended in this case is between 50 and 100 ft.c Details of fittings are again given. Further recommendations are made under "C" and "D" for seeing tasks under increasingly comfortable conditions, for which 30-50 ft.c. is desirable.

In general, the brightness ratio (max. to min.) in rooms should not exceed 10-1. Whilst measurement of equivalent foot-candles is not always an accurate method of determination of brightness it suffices in most cases to establish a satisfactory degree of contrast.

Maintenance.

In emphasising the importance of maintenance the Code presents a diagram illustrating the loss of light which results when the following factors are ignored: Regular replacement of lamps, periodical cleaning of reflectors, and redecoration of the room. The maximum deterioration allowed is 25 per cent.

Daylight.

In order to ensure good daylight conditions various recommendations are made. In the case of rooms where only one wall contains windows it is advised that the width of the room should not be more than twice the height of the top of the windows above the floor. The height of the windows in saw-tooth constructions should be at least one-third of the span. In general, single storey industrial buildings should have a window area of at least 30 per cent. of the floor area.

Reverting to artificial light, it is recommended that photometric relays should be adopted and that light sensitive cells should be applied to control lighting conditions in workshops automatically.

Types of Fittings.

Five main distinctions are made in available types of fittings, as shown in Table II.

TABLE II.—TYPES OF LIGHTING FITTINGS.

Classification.	Approx. Distribution of Lamp Output. Upward. %	Downward. %
Direct	0-10	90-100
Semi-indirect	10-40	60-90
General Diffusing	40-60	40-60
Semi-Indirect	60-90	10-40
Indirect	90-100	0-10

In connection with supplementary lighting (i.e.,

local lighting) it is emphasised that care should be taken that such fittings do not create glare when viewed from any angle.

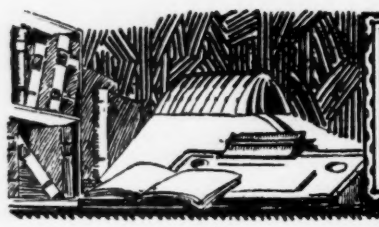
RECOMMENDATIONS ON WIRING.

Finally a word on adequate wiring is given and the intensive use of the "Handbook of Interior Wiring Design" is advocated. The following points deserve special consideration: a sufficiently large size of copper wiring should be adopted to prevent undue voltage drop. The installation should be flexible enough to allow for vital changes in utilisation, e.g., in case the positions of important machines, etc., are altered. A single lighting circuit should, in general, not exceed 1,000-watt; only for heavy duty lamps should 1,500-watt circuits be provided. The number of outlets per circuit should not be more than six for general manufacturing conditions and ten for storage areas. At least one panel board should be installed on each active floor. The feeder sizes should be based on the number of branch circuits provided, assuming 1,000-watt load for each lighting circuit and 500-watt for each spare circuit. The installation of over-size race-ways for additional feeders as a provision for future growth should be made. In general, the outlets for general illumination should be arranged in a way that any workman within a given area would get the benefit of several near-by lighting units.

H. L. J.

More Light?

In an article under the above title Mr. J. S. Dow ("Electrical Review," September 8) reviews the problem of fixing standards of illumination. The steady upward tendency during recent years is due largely to advances in the efficiency of illuminants. It is, however, just as important to eliminate glare and troublesome contrast which perplex the eye and diminish the "subjective brightness." Three types of standards are in use: (1) legal standards, (2) recommendations based on good "general practice," and (3) recommendations based on ideal performance. Of these (1) is necessarily much lower than (2), and (2) likewise considerably below (3). In determining standards the observer is limited by the fact that it is most difficult to *prove* that illumination below a certain value is prejudicial to health (even if one holds strong convictions on this point). Available data are based chiefly on performance. Useful confirmation of the I.E.S. "Recommended Values of Illumination" might be obtained by applying to them the analytical methods suggested by Mr. A. W. Beuttell in a paper before the Illuminating Engineering Society some years ago.



REVIEWS OF BOOKS AND PUBLICATIONS RECEIVED

The A.B.C. of Glass. G. S. Reynolds and G. P. Hughes. (Stone and Co., Ltd., London, 1939; pp. 160; price, 5s. 6d. post free.)

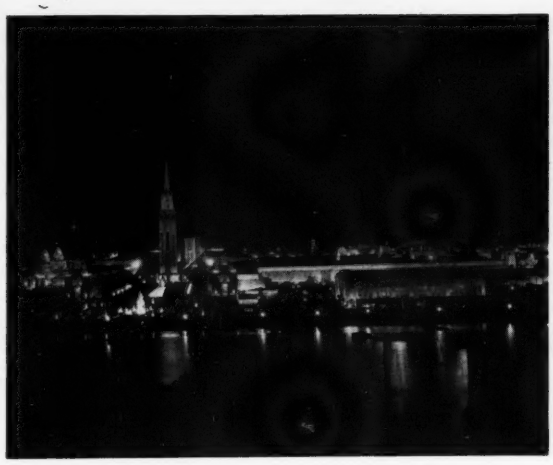
This book opens with an initial "literary note" in which the development of glass is sketched, and it is suggested that "the glass age" has arrived. Subsequently there are notes on the Modern Use of Glass and Glass Insurance, after which we come to the "A B C," in which a large number of terms used in connection with glass are arranged in alphabetical order and explained, in some cases explanations being supplemented by sketches and tabular matter. The final portion of the book consists of a series of plates in which the qualities of different forms of glass and their applications are illustrated.

The Story of the Lamp (and the Candle). F. W. Robins. (Oxford University Press, 1939; pp. 156; 15s. net.)

In the prologue to this work the author remarks that, having regard to the intimate part artificial lighting plays and has played in family, social, and ceremonial life, it is curious how little attention has been given to its history. Painters and draughtsmen have been in the habit of depicting night life without showing the source of light on which it is dependent! Mr. Robins has, however, managed to collect pictures of many interesting early types. In his twenty-four chapters he follows the progress of illuminants from the fire and the torch up to the coming of electricity. The book is divided into three sections dealing respectively with the torch to the candle, the lamp itself, and "sidelights," which include mine lamps, lighthouses, and street lights. To the lighting expert these final sections may prove quite as interesting as the major part of the book, in which pine splinters, classical lamps, and "crusies," etc., are portrayed in profusion. The book is illustrated by many effective plates, the paper and printing are excellent, and there is a bibliography containing a number of out-of-the-way references. The epilogue, devoted to the symbolism of light, contains some interesting sidelights on ceremonial. Glancing through the book one finds evidence in support of the author's belief that man's make-up and natural tendencies are similar in all periods. An incident in the Great War is recalled to illustrate this point—the ingenuity of certain troops on the Ypres salient, who, having been served with tins of sardines unfit to eat, bored holes in the tins, inserted pieces of string, and turned them into fish-oil lamps!

Practical Electric Illumination and Signal Wiring Methods, Terrell Croft, revised by H. G. H. Hall. (McGraw Hill Publishing Co., Ltd., 1939; pp. 350, figs. 292; price 18s.)

Since 1929, when the last edition of this work appeared, there have been numerous developments in the lighting field. These have been taken into consideration by the editor. A somewhat unusual feature of this work is that the matter dealt with in Parts I. and II. is so sharply divided that it is, in substance, two distinct textbooks within the same cover. In Part I. the author follows familiar lines in dealing with electric illumination. There are nine chapters dealing in turn with Fundamental Principles, Reflection, Electric Lamps (incandescent and discharge), Luminaires, Illuminating Engineering and Interior and Exterior Illumination. The explanation of fundamental principles is, considering the space available, done very fully. The same applies to measurements of light and calculations of illumination, though one would like to see more said in regard to illumination photometers of the visual and photoelectric type. The sections dealing with applications of light are also useful. In Part I., in fact, the author has managed to pack in a vast amount of condensed information. In Part II. the author, after summarising the rules of the "National Electrical Code," describes various types of cables and methods of splicing and supporting them, and common types of batteries; finally, he illustrates a number of typical wiring diagrams for bells, burglar alarms, lifts, etc. A feature is the liberal use of illustrations and diagrams, of which there are nearly 300 in the book.



Lighting at the Golden Gate Exhibition

Although this is a field of lighting which we in this country will unfortunately not be free to exploit for some time to come, readers will nevertheless be interested in the above views of the spectacular lighting at the Golden Gate Exhibition in San Francisco Bay. Some of the above views are featured in colour in an article reprinted by the General Electric Co. (U.S.A.) from the *Architectural Record*, which shows vividly the effective use made of colour floodlighting. The leaflet contains a description of the lighting effects by Mr. A. F. Dickerson, Director of Illumination, to whom a scroll was presented commemorating his work.

Literature on Lighting

(Abstracts of Recent Articles on Illumination and Photometry in the Technical Press)

(Continued from page 167, August, 1939.)

I.—RADIATION AND GENERAL PHYSICS.

213. New Means of Minimising Radiant Heat from High Level Lighting Systems.

D. Cannell, E. Q. Adams, J. C. Forbes. Am. Illum. Eng. Soc. Trans., 7, pp. 726-738, July, 1939.

It has been found that radiant heat falling on the body is one of the chief causes of discomfort in hot rooms. This can be reduced by the use of mercury-vapour lamps. For use where tungsten filament lamps are necessary, a new type of paint is described. This is claimed to reflect 75 per cent. of the visible light, but only 30 per cent. of the radiant heat falling upon it. The paint has a zinc oxide base and a secondary unspecified pigment. It is claimed that less discomfort is found in rooms treated with this material. J. S. S.

214. Notes on the Work of Klughardt and Richter on a Set of Colours of Equal Saturation.

J. Rosemann. Zeits. Techn. Phys., No. 7, pp. 198-203, July, 1939.

The author suggests a new interpretation of the original measurements, and compares the results with Schrödinger's Theory. A. E. S.

II.—PHOTOMETRY.

215.

John H. Jupe. Elect., 123, p. 70, July 21, 1939.

A brief description, with photographs, is given of a new American portable photo-electric photometer. A sensitivity of four to five micro amps. per foot-candle is obtained. The galvanometer unit in the equipment is claimed to be more robust than the average pivoted microammeter, and readings as low as 0.005 ft.c. can be obtained. C. A. M.

216. The Design of Photoelectric Flicker Photometers.

Parry Moon, D. P. Severance. Am. Illum. Eng. Soc. Trans., 7, pp. 801-825, July, 1939.

The photoelectric flicker photometer uses the cell as a null indicator, eliminating the effect of variations in the photocell characteristics. The conditions which must be satisfied are discussed, and design data for satisfactory shutters are given. With a properly designed instrument, true results can be obtained even with flickering sources such as discharge lamps operated on A.C. It is claimed that higher precision should be obtained than by any other photometric method, provided the illumination on the aperture of instrument is not less than 1 lumen/m^2. J. S. S.

217. A Colour Temperature Meter.

E. M. Lowry and K. S. Weaver. J. Soc. Mot. Pict. Eng., Vol. 32, No. 3, p. 298, March, 1939.

A meter is described which enables the colour temperature of incandescent light sources to be measured with the convenience and rapidity necessary in photographic and cinema studio work. The eye observes a two-part field, both of which parts receive light from the incandescent light source under test. One half of the field is covered by a gelatine filter which transmits in a narrow band in the orange only, and the other half by a gelatine filter which transmits in two narrow bands in the green and red. The filters are so matched that when the photometric field receives light of 2,100 deg. K, no colour difference between the two halves of the field is apparent to an observer with normal vision, but to light of any other colour temperature, a colour difference between the two halves of the field is observed. This difference can be eliminated by means of an amber filter covering both halves of the field, which in effect lowers the colour temperature of the source to 2,100 deg. K. Such an amber filter is introduced into the instrument in the form of an annular wedge, which is calibrated to bear a scale of colour temperatures. R. G. H.

III.—SOURCES OF LIGHT.

218. Daylight Variations.

H. L. Johnston. Am. Illum. Eng. Soc. Trans., 7, pp. 783-797, July, 1939.

Data are given on the daylight variations in Pittsburg over a period of twelve months ending August 1, 1938. The relation of these data to lighting schedules is discussed. J. S. S.

219. New Photoflash Lamp for Focal Plane Shutter Cameras.

Anon. Am. Illum. Eng. Soc. Trans., 6, p. 562, June, 1939.

A description of two new wire-filled photoflash lamps, for use with focal plane shutters. An unusually long flash period is claimed. Lamp No. 30 has a total light output of 40,000 lumen-seconds, and lamp No. 31, 70,000 lumen-seconds. J. S. S.

220. 4-ft. Fluorescent Lamp.

Anon. G.E. Rev., 7, p. 328, July, 1939.

A description is given of a new fluorescent tubular lamp 4 ft. in length and 1½ in. in diam. It is produced in two colours, daylight and warm white. J. S. S.

221. Cost of Lighting with Fluorescent Lamps.

W. C. Brown and J. C. Forbes. Magazine of Light, VIII., No. 4, pp. 18-20, June, 1939.

Comparative costs of ordinary incandescent and fluorescent lighting are considered in detail. C. A. M.

222. Fluorescent Lamps Aid Air Conditioning.

George J. Taylor. El. World, 112, p. 284, July 29, 1939.

The advantages to be gained by the use of fluorescent lamps in regard to their reaction on the air-condition requirements are discussed. This is of particular importance in windowless buildings, which are being used to an increasing extent, and especially so where closely controlled conditions have to be maintained. The economics are discussed and an example quoted. S. S. B.

223. Inductive Co-ordination with Series Sodium Highway Lighting Circuits.

H. E. Kent and P. W. Blye. Elect. Engineering, 58, p. 325, July, 1939.

The paper describes the wave-shape characteristics of the sodium vapour lamp, and discusses the relative inductive influence of various series circuit arrangements normally used. A method of estimating the interference noise in exposed telephone lines is outlined, and measures to assist in the inductive co-ordination of the two systems are described. The effect of a few lamps only is slight, and precautions are only necessary where a considerable number of lamps is involved. S. S. B.

224. New 40-watt [illegible]tor Showcase Lamp.

Anon. Am. Illum. Eng. Soc. Trans., 7, p. 663, July, 1939.

This 40-watt tubular lamp incorporates an internal

reflecting surface over half its area, so that external reflecting equipment is unnecessary. J. S. S.

IV.—LIGHTING EQUIPMENT.

225. The Control of Natural Light in Schoolrooms.
L. H. Brown. Am. Illum. Eng. Soc. Trans., 6, pp. 606-620, June, 1939.

A description is given of tests comparing the effectiveness of venetian blinds, plain cloth blinds, and aeroshades in the control of daylight illumination and brightness. Aeroshades direct light on to the ceiling only, while cutting out direct light from the windows. J. S. S.

226. The Evolution of Arc Broadside Lighting Equipment.
P. Mole. J. Soc. Mot. Pict. Eng., Vol. XXXII., No. 4, p. 398, April, 1939.

The advent of natural-colour cinematography has revived interest in the arc broadside (general floodlight) type of unit for cinema studios. Such a unit must be silent in operation. The development of the arc unit from early days is traced, and a description given of a new design of unit for colour work. R. G. H.

227. Operates Fluorescents at Unity Power Factor.
Anon. El. World, 112, p. 356, July 29, 1939.

Details are given of a new auxiliary for use with discharge lamps. Two lamps are operated off the one unit, which involves the split-phase principle, so that one operates at leading, and the other at lagging power factor, the combination being close to unity. The circuit is shown, and the advantages stated. S. S. B.

228. Portable Landing Field Lighting.
Anon. Elect., 123, p. 79, July 21, 1939.

A brief description is given of a system of portable aerodrome lighting equipment. Twenty units, each with its battery, cover an area 1,000 ft. long by 200 ft. wide. C. A. M.

229. New Equipment and Appliances.
Anon. Elect., 123, p. 108, July 28, 1939.

Details are given of a new moving neon sign recently installed in London. C. A. M.

230. The Action of Neophan Glass on the Visibility of Interference Fringes in White Light.
Clemens Schaeffer and J. Rosemann. Zeits. Techn. Phys., No. 7, pp. 193-198, July, 1939.

The effect is considered theoretically, and experimental results are quoted. A. E. S.

231. Plastic Materials.
Anon. Elect., 123, p. 45, July 14, 1939.

A brief description is given of the use in America of the internal reflective properties of certain plastic materials. Examples are luminous dials in aircraft and motor-cars and orchestral conductors' batons. C. A. M.

V.—APPLICATIONS OF LIGHT.

232. Brightness Contrasts in Seeing.
M. Luckeish and F. K. Moss. Am. Illum. Eng. Soc. Trans., 6, pp. 571-597, June, 1939.

It is claimed that the rate of involuntary blinking during reading is a satisfactory criterion of ease and comfort of seeing, and agrees well with other criteria, such as visual acuity and measurements obtained with the Luckeish-Moss visibility meter. Hence "visibility," as measured on this instrument, may be a measure of ease and comfort of seeing. Investigations on brightness contrast, using this criterion of blinking, are described, and the application of the results to practical lighting installations is discussed. J. S. S.

233. Light and Architecture.
Anon. Am. Illum. Eng. Soc. Trans., 6, pp. 565-570, June, 1939.

A description of some representative architectural lighting installations is given, with photographs. J. S. S.

234. Light and Architecture.
Anon. Am. Illum. Eng. Soc. Trans., 7, pp. 665-680, July, 1939.

Some representative architectural lighting installations are described, with photographs. The winning designs for the I.E.S. competition, lighting a hydro-electric plant, are analysed. J. S. S.

235. New Street Lighting Method.
D. G. Sandeman. El. Rev., Vol. CXXV., No. 3,217, p. 86, July 21, 1939.

Street lighting by means of luminous pylons is advocated as an alternative to the present methods. Glare would be reduced and visibility improved. The pylons could be used to display advertisements at a profit, which would pay for the installation and maintenance costs. R. G. H.

236. Lighting for Traffic Safety.
L. A. S. Wood. Elect. Engineering, 58, p. 287, July, 1939.

The author discusses the modern view on street lighting practice. Main traffic roads are most in need of attention. New fittings with suitable light distributions have been developed, and their applications are considered. The value of good street lighting is stressed and data on street accidents presented. S. S. B.

237. Fifth Avenue Jeweller Adopts Gaseous Discharge Lamps.
Anon. El. World, 112, p. 179, July 15, 1939.

Details are given of the lighting adopted in a number of different positions in an American jewellery store. Three types of gaseous discharge lamps are used, with a general tendency towards daylight colour of light. S. S. B.

238. Light Transition Louvers for High Speed Vehicular Tunnels.
R. W. Myers. Am. Illum. Eng. Soc. Trans., 6, pp. 621-626, June, 1939.

An installation of overhead louvres is described, designed to reduce the suddenness of the brightness change when entering and leaving a traffic tunnel. The method of designing the louvres is explained. J. S. S.

239. Mercury Vapour Street Lighting.
W. A. Darden. Am. Illum. Eng. Soc. Trans., 6, pp. 627-636, June, 1939.

The street lighting installations at Oklahoma and Arkansas using mercury vapour lamps are described. J. S. S.

240. Highway Illumination by Automobile Headlamps Under Actual Operating Conditions.
D. D. Davis, F. A. Ryder, and L. M. Boelter. Am. Illum. Eng. Soc. Trans., 7, pp. 761-782, July, 1939.

Measurements of roadway illumination by headlamps under actual operating conditions are correlated with laboratory measurements of the contrast sensitivity of typical observers. From these data an attempt is made to predict visibility distance under various conditions. J. S. S.

241. Practical Aspects of Farm Home Lighting.
Myrtle Fahsbender. Am. Illum. Eng. Soc. Trans., 7, pp. 739-760, July, 1939.

This paper discusses the economics of rural home lighting, and describes a range of appropriate lighting fittings. J. S. S.

242. Complementary Lighting.
"Pharos." Elect., 123, p. 90, July 28, 1939.

Points associated with the installation of complementary colour lighting for air raid protection purposes are raised. The author asks for data on the daylight transmission of the painted glass, and on the uniformity and possible deterioration of the paint. He points out that in winter artificial illumination would be often necessary throughout the whole working day, and finally inquires whether the system is not jeopardised by damage resulting from gunfire or blast. C. A. M.

243. School Lighting.
Anon. Magazine of Light, VIII., No. 4, pp. 25-36, June, 1939.

Numerous photographs are given showing results obtained for the various requirements of school lighting. C. A. M.

244. Industrial Lighting.
A. K. Gaetjens. Magazine of Light, VIII., No. 4, pp. 16-17, June, 1939.
Instances are given, with photographs, of the successful use of indirect lighting for various printing processes. C. A. M.

245. Railway Coach Lighting.
H. H. Helmbright. Magazine of Light, VIII., No. 4, pp. 14-15, June, 1939.
Details, with photographs, are given of lighting effects produced with fluorescent lamps in the coaches of the American train, "General Pershing." C. A. M.

246. Exterior Illumination of the Golden Gate Exposition, California.
A. F. Dickerson. Am. Illum. Eng. Soc. Trans., 7, pp. 681-708, July, 1939.
A detailed description, illustrated with photographs, is given of the exterior lighting at the Golden Gate Exposition. J. S. S.

247. Colour, Light, and Structure at Golden Gate Exposition.
A. F. Dickerson. G.E. Rev., 7, pp. 291-306, July, 1939.
A full survey of the lighting effects at the Golden Gate Exposition is given, with detailed descriptions of some of the equipment. Eleven full-colour plates are included. J. S. S.

248. The Electric Supply and Distribution System and Inside Lighting for the Golden Gate Exposition, California.
W. P. Bear. Am. Illum. Eng. Soc. Trans., 7, pp. 709-725, July, 1939.
A detailed description is given of the electric supply system and interior lighting at the Golden Gate Exposition. J. S. S.

249. The New Shore Theatre.
F. M. Falge. Magazine of Light, VIII., No. 4, pp. 12-13, June, 1939.
Details, with photographs, are given of lighting effects produced at the new Shore Theatre, in Cleveland. Daylight and other fluorescent lamps are used extensively. C. A. M.

250. Colour Fluorescent Lighting.
Anon. Magazine of Light, VIII., No. 4, pp. 10-11, June, 1939.
An interesting use of fluorescent lighting in a series of multiple stores in America is the use of alternate green and gold fluorescent lamps on the walls in order to introduce a decorative note. A unique feature, on the same series of stores, is the use of a group of three 1,000-w. water-cooled mercury lamps, producing searchlight beams on the roof of the building. C. A. M.

251. Even Illumination with Fluorescent.
Anon. El. World, 112, p. 199, July 15, 1939.
Photographs and a description are given of an installation of lighting drill presses, in which elliptical angle reflectors were replaced by fluorescent lamps in continuous troughing. Details are quoted, and a very even illumination of 45 foot-candles claimed. S. S. B.

252. Fluorescent Lamps for Permanent Exhibits.
Anon. El. World, 112, p. 208, July 15, 1939.
A description is given of the application of fluorescent lamps to the lighting of fabrics, furnishings, and model homes in a permanent exhibition in New York. One use is behind a glass brick wall in a modern house, to simulate daylight, with very effective result. S. S. B.

253. The Skyline Caverns.
J. H. Smith. Magazine of Light, VIII., No. 4, pp. 7-9, June, 1939.
A description is given of lighting effects produced in the Skyline Caverns, Virginia. Tungsten projection lamps, with colour filters, and daylight fluorescent lamps are used extensively. C. A. M.

254. The Camera Reports.
Anon. El. Times, 96, p. 51, July 13, 1939.
A number of photographs illustrate recent lighting installations. W. R. S.

Recent Patents

(Abstracts of recent Patents on Illumination & Photometry.)

No. 507,122. "Improvements in or Relating to Cathodes for Photoelectric Cells."

Electrical Research Products Inc. Dated June 26, 1937. (Convention U.S.A.)

According to this specification a photoelectric cathode in a closed container is prepared by producing a layer of silver sulphide upon a cathode support having a silver surface by means of a glow discharge in an atmosphere of hydrogen sulphide at low pressure and producing the vapour of an alkali metal in the container in such a manner that it diffuses into the layer of silver sulphide. The alkali metal is preferably caesium and the photosensitive layer comprises caesium, caesium sulphide, and metallic silver.

No. 507,639. "Improvements Relating to Fluorescent Material, More Particularly for Electric Discharge Lamps."

The British Thomson-Houston Company, Ltd. Dated December 17, 1938. (Convention U.S.A.)

According to this specification a fluorescent material comprises heat-treated magnesium oxide, silica, and an exciter, such as a manganese compound, prepared by a particular process described in detail in the specification.

No. 507,688. "Improvements in Directional Lighting Fittings."

The General Electric Company, Ltd., and Beggs, S. S. Dated March 9, 1938.

This specification relates to lighting fittings adapted to direct light from a point or line source so that there is at least one plane through the source (and, if the source is a straight line, perpendicular to it) wherein all the directions in which the intensity of the light is less than the maximum intensity in that plane, but is not substantially zero, lie on the same side of the direction in which the intensity is a maximum.

According to this specification such fittings comprise a plurality of refracting elements, each adapted to direct into different directions in the plane through the source light incident on different parts of it from the source. The ranges of directions into which the elements direct the light incident upon them all have one common limit which is the direction of maximum intensity, but have their other limits not common. Each of the refracting elements may be prism with a curved face.

No. 508,018. "Improvements in and Relating to Tubular Electric Incandescent Lamps."

Bartassot, M. Dated April 9, 1937. (Convention, France.)

According to this specification one end of a tubular lamp is convex, the other end is concave, and the lamp is provided with one contact cap midway along its length so that several such lamps may be assembled end to end to give a practically continuous line or outline of light.

No. 508,420. "Improvements in or Relating to Lighting Fittings."

Charles H. Bell and Co., Ltd., and Collinson, G. W. Dated April 19, 1938.

This specification covers a lighting fitting comprising one or more brackets and a plurality of bars or strips supported by the bracket or brackets vertically on edge and spaced laterally side by side so that light rays emitted from a source of light arranged within the fitting may pass directly between the bars or strips, and also, possibly, from an open side of the fitting, and may be distributed, but so that the source of light is not readily visible.

No. 508,718. "Improvements in or Relating to Paraffin Incandescent Burners."

Ehrich and Graetz Aktiengesellschaft. Dated February 2, 1937. (Convention, Germany.)

In paraffin incandescent wick burners the diffuser cap usually has some form of wick stop, either a flange or prongs or bridges. Prongs or bridges easily deform the wick, but a flange has a still greater disadvantage in that the heat is too rapidly transferred therefrom to the inner wick tube, with consequent creeping up of the flame and sooting of the mantle.

According to this specification, in a paraffin incandescent burner having a wick stop and a diffuser cap secured to the inner wick tube, the wall of the cap below the wick stop and above the inner wick tube is constituted as a spider, the openings of which are partially covered by wick guiding means received on the upper end of the inner wick tube, which may be of reduced diameter to receive the guiding means which may be constituted by a tubular extension of approximately the same outside diameter as the inner wick tube.

No. 509,052. "Improvements in or Relating to Vapour or Gas-filled Electric Discharge Lamps or Tubes."

Vereker, H. C., and Stickley, W. A. Dated January 18, 1938.

This specification relates to vapour or gas-filled electric discharge tubes in which two different discharges take place in order to improve or render more complete the spectrum of the total light emitted

According to the specification, a gas-filled electric discharge tube of the type usually operated in series with an inductance and a second discharge lamp of the type usually fed from a transformer having a comparatively high no load voltage are fed simultaneously, the former in series with a primary winding, and the latter from the secondary winding of a single transformer having a pre-determined magnetic leakage. The transformer is preferably of the shell type with the primary and secondary windings disposed co-axially on the central limb, leakage paths extending between the two windings from the central to the outer limbs of the core. The tubes may be respectively mercury and neon tubes.

No. 509,291. "Improvements in or Relating to Arc Lamp Cathodes."

Societe Le Carbone-Lorraine. Dated December 22, 1937. December 28, 1937. (Cognate Applications, Convention, France.)

According to this specification an arc lamp has an anode with a core mineralised with rare earth compounds and a cathode with a core mineralised with an ingredient which inhibits, or, at least, limits to an innocuous level the condensation on the cathode of carbides of the rare earths carried over from the anode. Thus the cathode may comprise commercially pure carbon enclosing a core consisting of carbon and at least one alkali metal compound containing no oxygen in the proportion of one atom of alkali metal to about 2.5 to 7.5 atoms of carbon. The alkali metal or metals may be halogenated. and may be a mixture of sodium fluoride and sodium chloride.

NOTES ON ILLUMINATING ENGINEERING ABROAD

(Specially Contributed—H. L. J.)

France

The above picture illustrates the method adopted in the Musées d'Art Moderne for the illumination of carved facades, etc., by means of concealed projectors. For this purpose about sixty projectors, skilfully concealed from view, are adopted. In general the beam is spread over an angle of 20 deg. to 30 deg. and the fitting is furnished with a satin-finished glass screen to aid diffusion and prevent harsh shadows. Attention may also be drawn to the manner in which the statues on the right are silhouetted against the bright background.

In "Lux" M. J. Maisonneuve discusses A.R.P. provisions from the point of view of the lighting expert. He recalls that even weak light can be seen at a considerable distance on a dark night—for instance, the light of a wax candle can be distinguished from a distance of 27 km. All provisions to be made should be safe when viewed from a height of 500 metres (approx. 1,500 ft.). Among types of fittings recommended is one for exterior illumination, which consists of a comparatively wide reflector with a metal strip painted grey. The latter is curved to touch a counter-reflector which houses the actual lamp. As light source a 2-watt neon lamp is recommended. The reflecting parts of the fitting are painted grey and the remainder black. Fittings giving direct light downwards should be equipped with 0.5-watt neon lamps. In cases where bare light sources are used a construction somewhat resembling one recently marketed in Holland is recommended. This consists of a 9-watt tungsten lamp with a black enamelled body and a concave bottom with a small translucent circular area of orange tinted glass, emitting the light in a downward direction only—this is also recommended for indoor use. The intensity of unscreened exterior light sources should not exceed 5/10 millionths candle-power!

Switzerland

The "Bulletin de l'Association Suisse des Electriciens" publishes the draft of new recommendations dealing with, among other matters, high tension discharge tube installations. It is specified that transformer units used for permanent installations shall not exceed 8 KV, and for transportable apparatus 4 KV. No bare part of the high tension circuit shall be nearer than 10 mm. to any earthed part of the installation for pressures up to 4 KV and not nearer than 20 mm. for higher pressures. Housings of electrodes shall be of non-inflammable material. The low tension circuit shall be protected against excessive pressure by an automatic device permitting a pressure rise to not higher than twice the normal value. Transformers using an earth connection for the high tension circuit are forbidden. For earthing the following is prescribed: The material should be copper, and its sectional area should be 6 sq. mm. if installed bare on porcelain pulleys, 2.5 sq. mm. if led through special tubing separate from the feeding wires, and 1.5 sq. mm. if located directly underneath the metal foliage of a feeder.

United States of America

In a paper delivered to the I.E.S. Conference at San Francisco this year and reproduced in the "Transactions" of the Society Miss Fahsbender discusses practical aspects of Farm Home Lighting. At the end of 1935 788,795 farms were electrified, and by the end of 1938 this number had increased to 1,410,000. Special difficulties experienced in promoting good farm lighting are as follows: All home lighting is still actually keyed for the urban home; only recently have fittings been developed which are definitely applicable to lighting of farm buildings. The main object, when considering this field of application, should be to keep the cost of the fittings low without sacrificing unduly the quality of lighting. Incomes derived from farms in general lie between 125 and 1,500 dollars per annum. The average accommodation on a farm building comprises kitchen, living room, dining room, hall entrances, porch, laundry, bathroom, and three bedrooms. A trade feature recently introduced for the promotion of farm lighting has been the so-called "Packaged fixtures," costing 18 dollars and providing for ceiling fixtures in kitchen, living and dining rooms, porch, and three bedrooms. If fixtures for bathroom and laundry, and for local lights in kitchen, etc., are included a total of 32 dollars 50 cents is arrived at—a price a farmer can, in normal circumstances, afford to pay. The usual budget for expenditure on lighting fixtures for a new farm home can be reckoned as 1½ per cent. of the cost of the building. The costs of erection of houses built on the initiative of the Farm Security Administration, and consisting of five rooms, bath, and two porches, lies between 1,000 and 1,500 dollars. The budget of 18 dollars previously mentioned would thus fall within the prescribed limit. There is a considerable market in this field. Already 10,000 such homes have been built.

Australia

A paper recently delivered by Mr. H. L. Watsford before the I.E.S. (N.S.W.) on "Air Conditioning and Heating Loads as affected by Modern Lighting Systems" is appearing in instalments in the "Australasian Engineer." Reference to the paper recently read by Mr. F. C. Smith in London* is made. As an indication of comfort it is recalled that an occupant of a room at rest or in sedentary work is dissipating heat at a rate of approximately 400 B.T.U. per hour (a figure which rises to 700 when "mild" physical work is being performed). The difficulty in meeting individual comfort requirements is less than might be supposed. A recent survey in U.S.A. showed that 97-98 per cent. of people approached were satisfied. Factors determining the sensation of comfort are radiant heat (received from hot objects or radiated to colder objects in a room), temperature, velocity and humidity of the air, and number of people in a room. For theatres it is assumed that one person per 6 sq. ft. of floor space, for restaurants one per 25 sq. ft., in shops one per 75 sq. ft., and in flats one per 100 sq. ft. is satisfactory.

* Trans. Illum. Eng. Soc. (London), July, 1938, p. 95.

A.R.P. Lighting Equipment

We invite from all firms in the Lighting Industry particulars of equipment of interest at the present time, and description of lighting installations in which special problems have been encountered and overcome.

In response to our request we have already received from a number of leading firms in the lighting industry particulars of special units for use in connection with A.R.P. Lighting. It is evident that in spite of the general black-out there will be ample scope for their activities.

We understand that several firms are already taking steps to market the special IES/ARP fittings, designed to furnish 0.002, 0.02, and 0.2 foot-candles, for which British Standard Specifications have recently been prepared.

Holophane, Ltd.—In addition to the fittings mentioned above there are many standard types of Holophane fittings which have proved to have special utility in the present circumstances. Thus Holophane prismatic bulkhead fittings, equipped with low wattage lamps, and with special louvres to prevent any light being emitted above the horizontal, are proving useful. "Widerlite" units have been specified in large numbers for use in underground air raid shelters, decontamination rooms, etc. For outdoor use (where permissible) a large size industrial reflector with a wide conical rim is available. There is also available a wide range of industrial units, which can be equipped with blue glass screens and used with lamps of low wattage.

Industrial units, Iron-clad, and Bulkhead units are available for use in all classes of munitions work, and many are already in use in important factories.

For shop lighting the Holophane built-in units are proving very serviceable. The Controlens system, which is so effective in limiting light spill and in directing light on the working plane is proving its value in the present circumstances, when control of light without absorption and waste should be the aim —especially in view of the forthcoming rationing of electricity.

Benjamin Electric, Ltd., have recently issued a leaflet emphasising the importance of maintaining good lighting in factories. Reference is made to the widespread practice of equipping windows with opaque screens of a relatively robust character in view of the danger of glass being broken during an air raid. As this form of screening is usually permanent and cannot readily be removed by day work will, in many cases, proceed continuously by artificial light during the day as well as at night. In such circumstances the importance of maintaining really good artificial lighting, such as will enable work to be carried out efficiently under war conditions, is evident. (Psychologically this development is of considerable interest to illuminating engineers since its effect will surely be to concentrate attention on artificial lighting, so that its value will be appreciated —if anything—even more than in normal times.)

Benjamin Electric, Ltd., are also to be congratulated on their promptness in issuing a leaflet referring to the special IES/ARP units mentioned above. Quotations are made from the British Standard Specifications relating to these fittings, a general view of which appears on the front page of the leaflet.

British Thomson-Houston Co., Ltd.—A leaflet illustrates a number of useful devices. Mazdalux reflectors, suitable for use with lamps of low power, are illustrated. Various special forms of lamps sprayed neutral or deep blue or black with a clear disc on the crown of the bulb are available. Other devices include air raid shelter signs and lighting units (the latter with a panel of wired glass and specially designed to meet the peculiar requirements in shelters) and miniature projectors capable of affording a patch of light for the revealing of street signs, etc. This uses a 15-watt "Pygmy" lamp and will illuminate signs up to 4 ft. in width. Of special interest is the reference to BTH ultra-violet illumination—the irradiation of fluorescent materials by ultra-violet rays from a "black" bulb mercury discharge lamp —which offers the only possible solution of certain problems. This method has proved of great value in power houses and other situations where it is necessary to reveal readings on instruments and the positions of controls. It has many other possible applications—e.g., for pilot lighting during the evacuation of darkened premises.

General Electric Co., Ltd.—It may be assumed that the G.E.C. is also interested in the various applications mentioned above, and it is common knowledge that a considerable amount of valuable work has been done on the applications of fluorescent and phosphorescent materials excited by ultra-violet radiation—some demonstrations of which were shown at Wembley a few weeks ago. A useful view of the general position is afforded in a recently issued leaflet, in which advice in regard to indoor and outdoor lighting is accompanied by quotations from official regulations. Here again the applications of ultra-violet fluorescent lighting are mentioned. Reference is also made to the useful "Osglim" argon-filled 5-watt lamps which, besides emitting a feeble visible light, also give out an appreciable amount of ultra-violet radiation.

(Incidentally, the company has not been deterred by the present situation from issuing its new lamp catalogue—an excellently got-up production in which many special forms of lamps are re-listed.)

L. G. Hawkins and Co., Ltd.—A very wide range of products is illustrated in the leaflets issued by this firm. Of special interest is the "Supreme 999" emergency lighting units, which consist of a battery and torch capable of being stood on end, suspended, or carried, and with great flexibility of movement. Louvre-designs for application to signs and hurricane lamps, etc., are also illustrated. Finally, there is a good range of simple screens for household use or adaptation to motor-car headlights—some of which, naturally, may not meet the illuminating engineer's ideal requirements in regard to efficiency, but are nevertheless of undeniable utility to harassed citizens now endeavouring to effect a black out.

Electrical Association for Women

In these days of evacuation it is refreshing to note that the E.A.W. is continuing to operate at Regent Street, where the staff are now fully occupied in national service. In particular, the E.A.W. has been prompt in applying itself to the clarification of the rationing of electricity, and has issued a pamphlet giving advice in regard to the best methods of making economies. In another production dealing with "Evacuation Catering," the diet needs of the growing child are scientifically tabulated.

Osira 85-watt Sodium Lamps in G.E.C. reflectors at Bootle—an interesting example of the "cut-off" type of installation, with light limited to a region below 75°-80°.

The Illuminating Engineering Society (U.S.A.)

Notes on Transactions (July, 1939)

NEWS: On May 16 the group "Indoor Design and Decoration" held its first meeting in the Electrical Testing Laboratories, New York, and passed the judgment that *fittings designs* submitted to them for approval *showed the fault of having excessive ornamentation*, and for that reason had proved unacceptable. This year's "Better Light, Better Sight" programme will be carried out on an unusually large scale and will be *initiated by the "Better Vision Week,"* sponsored by the Better Vision Institute. Dr. Kennelly, a past-president of the Society, died on June 18 in Boston. He was Professor of Electrical Engineering at the Harvard University from 1902-30, and was Professor Meritus of both the Harvard and Massachusetts Institutes of Technology until his death. The Chicago Lighting Institute recently carried out a *Garden Lighting Show*. A special 40-watt show-case lamp, combining reflector and lamp is announced. Provision is made to ensure beam distribution in the desired direction by means of a short spring attached to the bottom contact of the lamp.

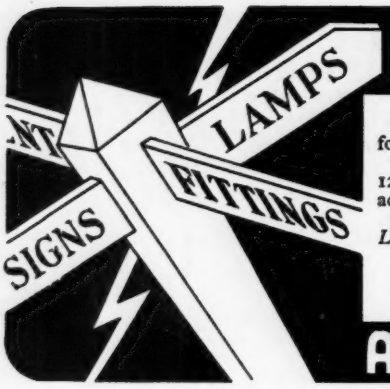
SUBJECTS OF PAPERS: *"The Exterior Illumination of the Golden Gate International Exposition, San Francisco."* By A. F. Dickerson. A very detailed account of the exterior lighting scheme, including particulars of specially constructed fittings used, is given. To produce the desired floodlighting effects 10,163 units were used. In addition 994 units for decorative lighting are given in the table and 673 for utilitarian street lighting. Total load for lighting only is estimated at 7,500 Kw.

"A Description of the Electric Supply and Distribution System and Inside Lighting for the Golden Gate International Exposition, San Francisco, 1939." By W. P. Bear. Total load of the Exposition for all purposes is given as 16,000 Kw., and the estimated consumption throughout the period it is open is expected to be approximately 50,000,000 units. The power is supplied by a main sub-station with 4 KVA step-down transformers. Electrical service for power and light is distributed radially from a main sub-station of 15 2,300-4,000-volt three-phase, four-wire circuits. There are approximately forty transformer sub-stations on the island.

"A New Means of Minimising Radiant Heat from High Level Lighting Systems." Authors: D. Cannell, E. Q. Adams, and J. C. Forbes. The desirability of minimising radiant energy from lighting plants is discussed.

"Measurement of Highway Illumination by Automobile Headlamps under Actual Operating Conditions." By D. D. Davis, F. A. Ryder, and L. M. K. Boelter. The result of investigations of the efficiency of head lamps, as investigated under practical conditions on cars chosen at random on the road, are given.

"Daylight Variations." By H. L. Johnston. A study of daylight variations resulting from seasonal weather and industrial conditions, and their relation to the illumination in schools, offices, industry, and to street lighting operating schedules.



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We invite applications for spaces in this new section of the journal. Particulars of terms for each space (approx. 1 inch deep and 3¼ inches wide) are given below.

These terms are equivalent to **half our ordinary advertising rates**, but not less than 12 successive monthly insertions can be accepted on this basis, and amounts are payable in advance.

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Specialists in the Science of Modern Lighting, including:
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for all requirements
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The Proprietors of Letters Patent No. 446615 entitled "Electrical Luminous Discharge Device for the Production of Green Light and Glass Tubing for the Manufacture thereof" desire to grant licences to interested parties on reasonable terms for the purpose of exploiting the same and ensuring its full commercial development and practical working in this country.

Enquiries to be addressed to Edmund Hunt and Co., 98, West George-street, Glasgow, C.2.

Index to "Where to Buy"

N.B.—The numbers are those attached to individual entries in the Directory (See pp. 204—206)

Searchlight Reflectors

An instructive leaflet issued by G. A. Parsons and Co., Ltd., describes the properties of searchlight reflectors and means of testing them. Searchlight reflectors of silvered glass have been made by C. A. Parsons and Co. for nearly fifty years. Many special devices have been developed, such as the lead and wire backing introduced during the last war in order to minimise the risk of a searchlight being put out of action by an accident to the reflector. Tests of performance include tests of focal length, the "Tchikoleff Test" based on the observation of the projection of a network of fine vertical and horizontal wires, and the "Zone Test," which serves as a check on parabolic form. By making a reflector in halves, which are hinged together, it may be used to project either a single beam of light or two beams making any desired angle one with the other.

Of special interest are the new rhodium-plated metal reflectors introduced for searchlights, floodlights, street lighting units, etc. The reflecting surface is of electro-deposited rhodium, giving a high reflectivity and a brilliant white colour immune from tarnish. As this is a "first surface" reflector, inconvenient effects from secondary surfaces are not experienced.

Lighting Exhibition at the I.I.C. Meeting in Holland

Our attention has been drawn by Messrs. Philips Lamps, Ltd., to an apparent misunderstanding in regard to one feature of the interesting exhibition staged by Messrs. Philips Lamps, Ltd., at the Palace Hotel, Scheveningen, during the recent I.I.C. gathering in Holland, which was the subject of comment in our issue of July, page 146. We understand that the full and correct description of the projectors on view was as follows:—

One complete projector, housing 2 MB 1,000W. lamps, each giving 250,000 c.p. Each of them mounted in conjunction with a cylindro-parabolic mirror.

One complete projector, including complete cooling set, housing one MD 2,000W. lamp, giving 900,000 c.p. The lamp was mounted in conjunction with a cylindro-parabolic mirror.

Crystallite Signs

This form of sign, which is listed by Strand and Interchangeable Signs, Ltd., is of the form illuminated by a concealed tubular source, usually above the design, which appears on glass. When illuminated the design stands out boldly. This neat and compact device is excellent for notice-signs, such as are widely used in hotels, shops, garages, etc., and for exit-signs in places of entertainment. The idea can also be effectively applied to furnish luminous house-numbers (a much needed improvement in many suburban streets) and to reveal the dials of clocks.